Parallel Imaging of TOSHIBA "SPEEDER"

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Introduction

In order to make parallel imaging (PI) technique [1-3] more practical, development of a post-processing algorism and PI dedicated phased array coils is essential. In this paper, the features of our PI technology "SPEEDER" are discussed with PI applications.

Array Coil Design

In the design of PI dedicated array coils, the following factors should be carefully taken into consideration: higher SNR in order to compensate for an intrinsic SNR loss caused by reduced number of phase encoding steps and a g-factor effect and flexibility of selecting the phase encoding direction for an arbitrary oriented imaging plane. To achieve higher SNR, shorter coil elements in the Z direction and QD configuration of surface coils are adopted. For the flexibility of selecting any imaging plane, RF coils are designed so that at least two elements are allocated in all X, Y, and Z directions. Our carefully designed torso array coil consists of eight QD surface coils, lining two elements in all three directions [4]. The head array coil comprises three QD surface coils and four linear coils [5]. Recently, a neurovascular (NV) array coil, combining the head array coil and an NV coil attachment, is newly developed [6].

Post-processing Algorithm

In PI, image domain techniques [2,3] are widely used. However, fold-over aliasing artifacts (FAA) are often observed in the center of images, particularly in case that the finally reconstructed full FOV images are smaller than the objects [7]. We have developed an Extended Parallel Imaging Algorithm for Unfolding (EXPAND) algorithm, which effectively suppresses FAA by unfolding the data to a larger extent of the area than specified [8].

Applications

The benefit of PI has already been reported in variety of ways. The higher temporal and/or spatial resolution imaging and echo planner imaging with reduced distortion are the typical

examples. Here we present some novel approaches that were achieved by taking an advantage of PI.

4D-MRDSA

In 3D time-resolved contrast enhanced MR angiography, combination of several techniques such as TRICKS [9], elliptical centric view ordering [10], and PI has an extensive increase in speed of data acquisition and provides temporal resolution of less than one second without compromising spatial resolution. The result of the imaging speed allows clear observation of hemodynamics in order to depict the disease or irregularity [11].

Non-contrast-enhanced MRA

Recently developed flow-spoiled fresh blood imaging (FBI) using half-Fourier FSE, a non-contrast-enhanced MRA technique, shows tremendous advancements with PI in not only scan time improvement but significant improvement in image quality [12]. In terms of image quality, a T2 blurring effect has been reduced in result of decreasing a single shot time with application of PI.

Conclusion

Various PI techniques have been developed from the both points of software and hardware approaches so that clinical setting becomes truly practical.

References

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